

COMPACT FOLDABLE KEYBOARD

FIELD OF THE INVENTION

This invention relates to portable electronic devices having monitors and keyboards, and more particularly, to portable personal computers such as notebooks, subnotebooks and pen computers, and means for providing more keyboard space for these types of computers without sacrificing their compactness by incorporating a foldable keyboard.

BACKGROUND OF THE INVENTION

Portable personal computers have developed from early luggable "suit case" designs, through the smaller "laptop" design, and now, with the aid of increasingly smaller packaging to "notebook," "sub-notebook" and personal digital assistants (PDAs) such as pen computers. While early portables were bulky and inefficient, laptops, notebooks and personal digital assistants have considerably improved the state-of-the-art by providing a battery supply, light weight circuitry and computer storage devices in a compact housing that can easily be carried by the user. As development of portable personal computers has advanced, substantially the full function of a more conventional desktop machine has been retained in the larger model such as the notebooks, while the subnotebooks typically lack floppy disk drives and the PDAs also typically lack keyboards due to their small size.

A "notebook" personal computer is about the size of a conventional loose leaf binder holding letter size paper, and typically weighs about 5-8 pounds. PDAs typically are too small to incorporate a keyboard and therefore often use a pen as the main interface for input. PDAs may weigh less than one pound to about 3 pounds with a screen size of about 5 by 7 inches or smaller. Those portable computers having size, weight and performance lying between the notebook and PDA are typically referred to as subnotebooks. In many portable notebook computer models, a keyboard compartment is hinged to a display screen compartment in such a manner that it is possible to fold the display screen compartment down against the keyboard compartment and to latch the two together. PDAs typically are a single enclosure with a screen on the top surface.

A limitation on the reduction in the size of personal computers has been the desire of users for a keyboard at least approximating those known and used with desktop and floor standing machines. Such conventional keyboards typically have an elongated rectangular form with alphanumeric keys arrayed in rows and staggered columns and with special function keys appropriate to the personal computer arrayed around the alphanumeric keys in a standard array. Such keyboards may have varying numbers and arrangements of keys, and several such arrangements have become more or less conventional and known by the number of keys provided. As efforts have been expended toward reducing the physical size of portable personal computers, some designers have chosen to reduce the size of the keys and thus the keyboards, while others have chosen to eliminate or combine certain functions provided in more conventional keyboards. Such efforts have succeeded to the point that notebook portable personal computers have had some success in the marketplace, however users of such computers often have complaints about key size and keyboard arrangement as compared with more conventional keyboards used with desktop machines. Restraints on key size and arrangement have effectively imposed a lower size limitation on keyboard

length and width of about the size of a sheet of correspondence stationery. Moreover, because the alphanumeric keys must be of sufficient size to accommodate even large fingers, certain keys are often deleted or rearranged from their "usual" position on the keyboard to retain compactness. These accommodations have made it more difficult for many users to transfer their typing skills to the smaller keyboards, have increased the likelihood of user error, and have sacrificed the available options associated with the missing keys.

SUMMARY OF THE INVENTION

This invention provides portable electronic devices, such as PDAs with the optional capability of a full size keyboard or a smaller keyboard similar to those commonly found in notebooks or subnotebooks. This invention releases the PDA from being limited to pen input, allowing greater flexibility and easier input for the user. In other embodiments, the present invention provides laptops, notebooks and subnotebooks with full function keyboards which approximate the size of a typical desktop computer keyboard when in use, but significantly smaller dimensions when in a non-use configuration. The increased keyboard size permits comfortable typing with layouts familiar to users without sacrificing the light weight and compactness normally associated with smaller portable computers.

In an embodiment of the invention, a portable pen computer is provided which includes a housing having substantially planar top and bottom surfaces. The housing also includes first and second keyboard sections which are connected by a first hinge to allow the sections to be folded together. The keyboard sections are attached to the housing with a second hinge for permitting pivotal rotation for deployment from a storage position in the bottom portion of the housing. The first hinge located between the keyboard sections divides the keyboard lengthwise into a top section and a bottom section, the top section having the function keys, number keys and the top row of alpha keys, and the bottom section having the bottom two rows of alpha keys and the spacebar row of keys. In the storage position, the key surfaces of the keyboard sections are facing one another for protection of the keys when not in use. In a deployed position, the first and second keyboard sections are designed to form a substantially full-size keyboard. The planar top surface contains a display screen which can also be used for pen input of data.

In another embodiment of the present invention, the hinge between the two keyboard sections is located between the left and right hand sections of the keyboard such that the hinge runs vertically from the top center of the keyboard to the bottom. To stow the keyboard, the first keyboard section is folded from right to left, on top of the second keyboard section. The two keyboard sections are then pivoted under the housing with the keys of the two sections facing each other and the back of the first section facing outward and becoming planar with the bottom of the housing.

In an additional embodiment of the present invention, a keyboard is comprised of three sections connected by two hinges, with a third hinge used to fold the keyboard sections into the bottom of the housing. An advantage of the present invention is illustrated in this embodiment which may allow the implementation of a full-size, desk-top like keyboard to be implemented on a PDA or notebook computer.

In another embodiment of the present invention, the hinge between the two keyboard sections is located between the left and right hand sections of the keyboard such that the hinge runs vertically in a straight line from the top center of